

Note: i) Question paper consists of Part A, Part B.

ii) Part A is compulsory, which carries 25 marks. In Part A, answer all questions.

iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.

PART – A

(25 Marks)

- 1.a) What is the toggle position of a mechanism? [2]
- b) What is the difference between the Crank–Rocker mechanism and Double–Rocker mechanism? [3]
- c) Define Instantaneous center of rotation. [2]
- d) The Fig.1 given below shows a geometric construction for slider crank mechanism.

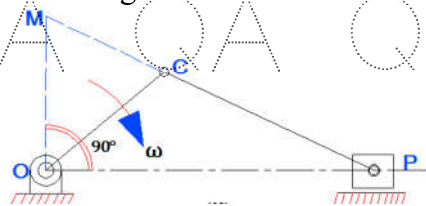


Fig 1

- Name the construction, and write the values of the velocities of slider and connecting rod in terms of ω . [3]
- e) What is the main advantage of the Hart mechanism over the Peaucellier mechanism, and what is its limitation? [2]
 - f) What are the limitations of a single Hooke's joint? How are these limitations overcome in a double Hooke's joint? [3]
 - g) Define tangent cam. [2]
 - h) Define trace point in the study of cams. Where does it lie in the case of (i) knife edge follower, and (ii) roller follower? [3]
 - i) State the law of gearing. [2]
 - j) What are the externally applied torques used to keep the gear train in equilibrium? [3]

PART – B

(50 Marks)

- 2.a) Distinguish between completely, successfully, and incompletely constrained motions. Give one example by sketch for each type.
- b) A double slider mechanism is used to draw an ellipse with major axis equal to 20 cm and minor axis 15 cm. Set out the mechanism and draw the locus of the points tracing the required ellipse. [5+5]

OR

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3.a) For the kinematic linkages shown in Fig.2, determine the degrees of freedom.

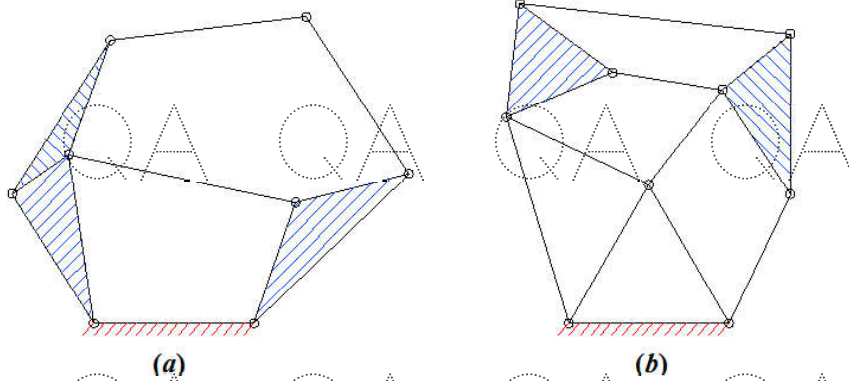


Fig.2

b) Identify the mechanism in Fig.3 below. Make a kinematic sketch of the mechanism and explain its working. [5+5]

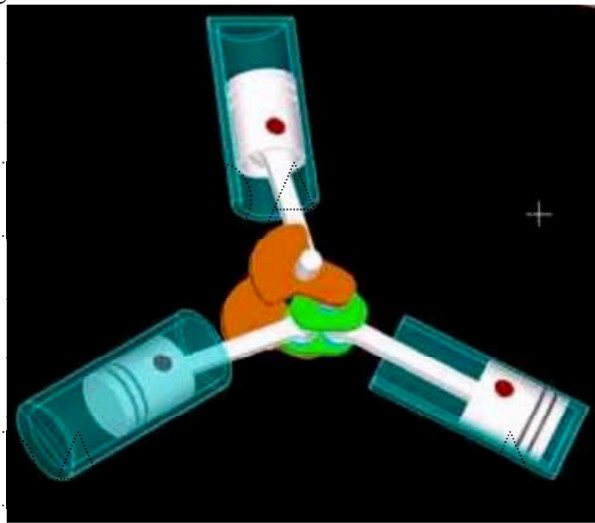
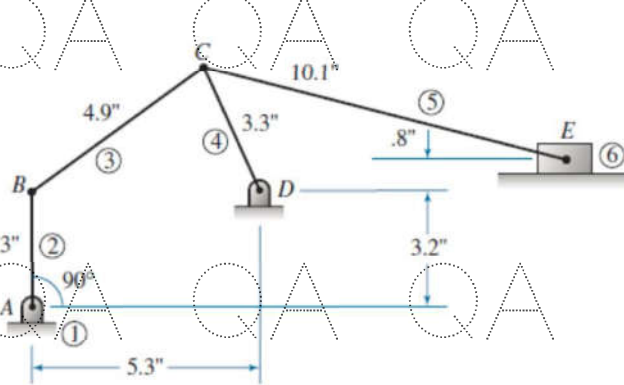


Fig.3

4.a) Define the term 'Relative Velocity'. If AB is a link rotating with a known uniform angular velocity, then how do you find the velocity of point B in terms of that of A?

b) A mechanism is shown in Fig.4 below where AB is the driving crank which rotates uniformly at 240 rpm ccw. Find the velocity of slider E by instantaneous center method. [5+5]

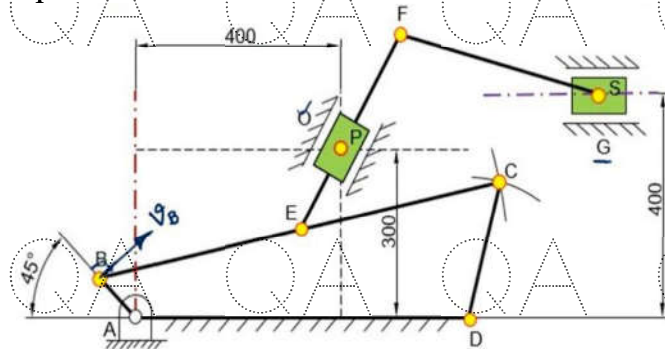


(All dimensions in the figure shall be taken as cm) **Fig.4**

OR

QA QA QA QA QA QA QA QA QA

- 5.a) Explain the coriolis component of acceleration with a sketch.
 b) For the mechanism shown in Fig.5, find the velocity of slider S, if the crank AB rotates uniformly at 300 rpm. [5+5]



(All dimensions are in mm. Dimensions which are not given may be assumed proportionately)

Fig.5

- 6.a) Distinguish between the Davis and Ackermann steering gears wrt their advantages and limitations.
 b) Two inclined shafts are connected by means of a universal joint. The speed of the driving shaft is 1000 r.p.m. If the total fluctuation of speed of the driven shaft is not to exceed 12.5% of this, what is the maximum possible inclination between the two shafts? Also find the angles of shaft rotation at which the speeds of driving and driven shaft are same. [5+5]

OR

- 7.a) Draw a neat sketch of the Hart straight line motion mechanism and prove that it produces an exact straight-line motion.
 b) In a Hooke's joint, if θ is the angle through which the driving shaft is turned, and α is the angle of inclination of the axis of driven shaft to that of the driving shaft, find the value of θ for which the speeds of the driving and driven shafts are equal. [5+5]

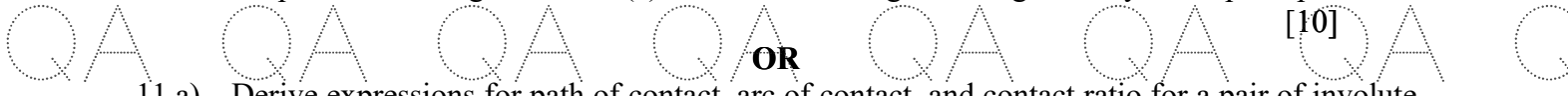
8. Draw the profile of a cam to give the following motion to a knife edge follower. Follower to rise through 40 mm during 150° of cam rotation with S.H.M. Follower to dwell for the next 30° of cam rotation. Follower to return to the initial position during 90° of the cam rotation with uniform velocity. Follower to dwell for the remaining 90° of cam rotation. Take the minimum radius of the cam as 30 mm. [10]

OR

9. In a symmetrical tangent cam, operating a roller follower, the least radius of cam is 30 mm, and the roller radius is 18 mm. The angle of ascent is 70° and the total lift is 18 mm. Speed of the cam shaft is 600 rpm. Calculate the (a) principal dimensions of the cam, (b) accelerations of the follower at the beginning of the lift where the straight flank merges into the circular nose, and at the apex of the nose. Assume that there is no dwell between ascent and descent. [10]



10. Two spur gears in mesh have a module of 8 mm and a pressure angle of 20° . The larger gear has 57 teeth while the pinion has 23 teeth. If the addenda on pinion and gear wheels are equal to one module, find the (a) number of pairs of teeth in contact, (b) angle of action of the pinion and the gear wheel, (c) ratio of the sliding to rolling velocity at the pitch point.



- 11.a) Derive expressions for path of contact, arc of contact, and contact ratio for a pair of involute gears in contact. [10]
- b) The arm of an epicyclic gear train rotates at 100 rpm anti-clockwise. The arm carries two wheels A and B, having 36 and 45 teeth respectively, and meshing with each other. Wheel A makes 200 rpm clockwise, and the arm rotates about the center of wheel A. Find the speed of wheel B. [5+5]

